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BACTERIAL CANKER OF TOMATOES

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HISTORY OF THE DISEASE

The Grand Rapids disease, or, as E. F. Smith has renamed it in his textbook,¹ bacterial canker of tomato, was first described by him²

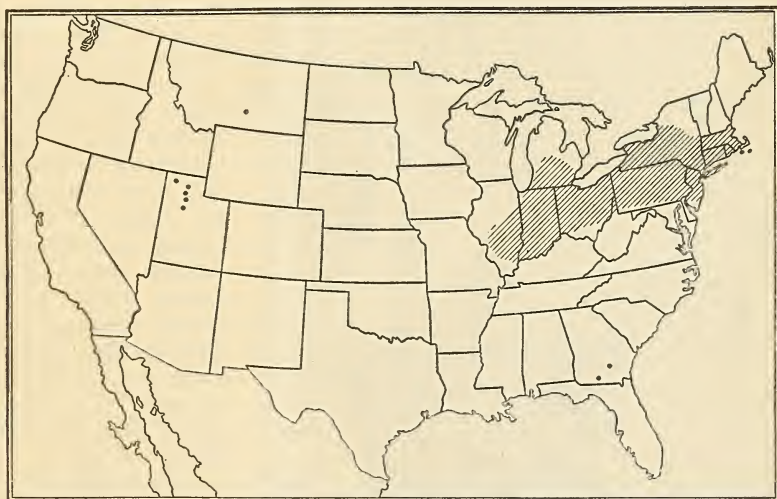


FIG. 1.—Map showing region (shaded) where bacterial canker of tomatoes was known to occur prior to 1927 and points outside of this area (dots) where serious outbreaks were reported in 1927

in 1910 from Michigan. Since that time it has been reported from many localities. Until the summer of 1927 it appeared to be a strictly northern disease confined to a belt of States stretching from Illinois eastward to the coast. (Fig. 1.) It was also reported from British Columbia by McLarty^{3 4} in 1925 and again in 1926.

¹ SMITH, E. F. AN INTRODUCTION TO BACTERIAL DISEASES OF PLANTS. 688 p., illus. Philadelphia and London. 1920.

² A NEW TOMATO DISEASE OF ECONOMIC IMPORTANCE. (Abstract.) Science (N. S.) 31: 794-796. 1910.

³ McLARTY, H. R. A BACTERIAL DISEASE OF TOMATOES NEW TO BRITISH COLUMBIA. Canada Dept. Agr. Rpt. Dominion Bot. 1924: 75-77. 1925.

⁴ REPORT OF THE DOMINION FIELD LABORATORY OF PLANT PATHOLOGY, SUMMERLAND, B. C. Canada Dept. Agr. Rpt. Dominion Bot. 1925: 115-116. 1926.

The disease has now appeared, however, in virulent form in the far South and West; and since it often occurs in the same field with Fusarium wilt, Verticillium wilt, or southern bacterial wilt (*Bacterium solanacearum*), it seems probable that it also exists in States



FIG. 2.—Tomato plant infected through the roots with bacterial canker

Utah, where it had hitherto been unknown. It was also found in Montana on plants grown in Utah.

from which it has not yet been reported, but is being confused with these other better-known diseases.

In 1925 the bacterial canker was reported for the first time in Illinois on plants from Georgia. Although no evidence could be obtained that the plants brought the disease with them, the facts were suggestive, and as a result, through the cooperation of O. W. Boyd, of Georgia, a survey of the chief tomato-growing sections of that State in June, 1927, resulted in finding the disease there taking heavy toll on a group of farms comprising 500 acres of tomatoes in one county and on a small acreage in another county.

In 1927 an outbreak of alarming proportions occurred in five counties in

ECONOMIC IMPORTANCE

Although the first outbreak in Michigan was on large commercial plantings, many of the later outbreaks have been on smaller acreages, but with a large percentage of loss. Much damage has also been reported on hothouse tomatoes, and in some States, as Ohio, the occurrence of the disease has been confined to hothouses, where the damage has been serious. Losses of from 1 to 50 per cent have been

reported at various times in both field and hothouse, and often fields have been plowed up as worthless.

In Georgia losses ranged from 10 to 50 per cent, and in some parts of fields as high as 70 per cent of infection was found. Reports from Utah place the percentage of loss at from 2 to 60 per cent in the most important tomato-growing sections. McLarty⁵ in his report of the disease for 1925 in British Columbia gives the average loss as 3 to 5 per cent, with some cases as high as 40 per cent. Large commercial plantings in Michigan also suffered heavy losses in 1927.

DESCRIPTION OF DISEASED PLANTS

In general appearance plants attacked by bacterial canker look more like *Fusarium*-infected plants than like those with the southern bacterial wilt (*Bacterium solanacearum*). (Fig. 2.) Infected stems are stunted. The disease progresses from the lower leaves upward. Stems and petioles remain turgid, while the leaflets wilt or turn brown and die. The leaf then frequently shrivels, hanging from a spur of petiole. Often one side only of a plant is attacked, in which case the plant lies to one side rather noticeably. Yellowish white streaks, frequently becoming gray-brown, appear on the stems, especially on the tender upper part where infection has reached the bark and lies close to the surface. These streaks often crack open, forming cankers (fig. 3, 4, and 5), which are one of the most characteristic signs of the disease.

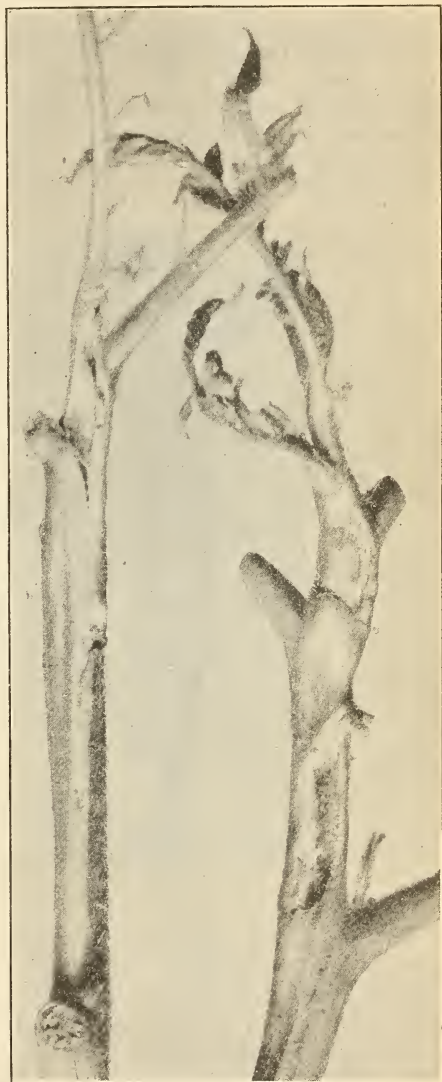


FIG. 3.—Cankers on very young stems. A yellow streak shows on the lower part of the left-hand stem

⁵ McLARTY, H. R. 1926. Op. cit.

The bacteria prefer the tender tissues of the plant, especially the inner phloem, and the wood separates readily from the pith along this line of heaviest infection. Large areas in the pith next to the wood become diseased and yellow (fig. 6, A) and later form cavities (fig. 6, B). These may be yellow or reddish brown in color, depending on the age of the infection.

It is often difficult with the naked eye to find evidence of infection in the root or crown of the plant; at other times a yellow or reddish brown discoloration is quite evident in or near the pith, sometimes in a single small area, sometimes taking the whole circumference of the inner wood, and in very early stages threads of yellow may be found in the wood.



FIG. 4.—Cankers on older stems

The succulent bases of the petioles of infected leaves are always heavily infected, and a cut across one of these always shows the characteristic yellowish or reddish brown discoloration with or without cavities, frequently involving all the tissues.

The plants may succumb to the disease early and be completely dead before reaching the blossoming stage or at any time after that up to and including the bearing period. The disease progresses more rapidly on high, dry land than in moister locations, and on poor land it is worse than on more fertile, well-tilled soil.

The bacteria reach the seed and penetrate the seed coat through the vascular system without external evidence of injury to the fruit, although such fruits when cut open show extensive yellow discoloration in the placenta, which swarms with bacteria. In other cases when fruits are severely infected while very young they become

stunted and distorted. (Fig. 7.) Unless so distorted, diseased fruits ripen normally or somewhat prematurely. The organism does not produce a rot of the fruit, nor has it been possible to produce a

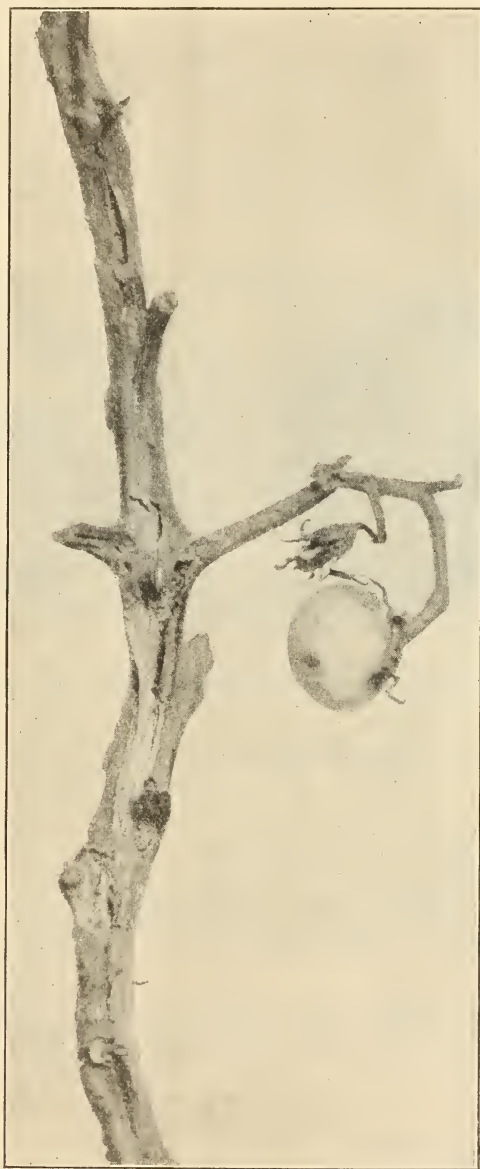


FIG. 5.—Old cankers

fruit rot by direct inoculation of the organism into stem end, blossom end, or sides of fruits of varying ages. Diseased plants usually mature a very small crop. On the most seriously infected plants no fruit reaches normal size. Seeds from diseased fruit are sometimes

brown, often have a brown spot on the side, but more frequently appear perfectly normal and give a high percentage of germination.

CHARACTERS FOR DIAGNOSING BACTERIAL CANKER

Where bacterial canker is fairly well advanced the cankers are one of the most characteristic signs of the disease, although in earlier stages these may not have appeared and sometimes do not occur even in advanced cases. The yellowish color of the diseased tissues in the younger parts of the diseased stems and the position of these yellowed areas or the cavities which follow them in the pith adjoining the wood are then the best guides. The lack of ooze and the mealy appearance of infected tissues are also characteristic.

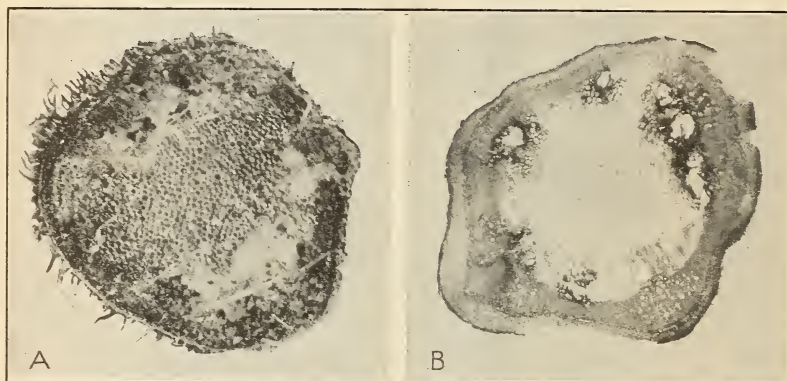


FIG. 6.—Cross sections of stems infected with bacterial canker. A, stem showing infected areas (white) where cavities are forming; B, stem showing position of cavities

Table 1 gives a comparison of this disease with other wilts of tomato.

TABLE 1.—*Comparison of tomato wilts*

| Bacterial canker | Southern bacterial blight | Fusarium wilt |
|---|---|--|
| No general wilt, but progressive wilting and death of leaves from the base of the plant upward. | Wilt of the whole plant, which often recovers at night during early stages. | "Sleepy disease," so called because of the general wilt of the tops of the plants. Yellowing, wilting, and death of the leaves from the base upward. |
| Yellow or brown streaks on the stems, which crack open, forming cankers. Yellowish white discoloration in inner wood and pith, becoming red brown in old lesions. | Brown discoloration in the wood and often in the pith of root and stem, not extending so high in the plant as in Fusarium wilt. | Dark-brown to black discoloration of the wood of root, stems, and petioles, extending to the tops of the branches in advanced stages. |
| No ooze from cut ends of stems. | Conspicuous grayish white ooze from the cut ends of stems or roots. | No ooze from cut ends of stems. |
| Cavities in the pith adjoining the woody ring. Stunting of infected branches. | | |

CONTROL

Further work must be done to determine with certainty the method by which the disease is spread. It is certain that it may be carried in young plants which are shipped in such vast numbers from place to place. The outbreak in Montana is evidence of this. Young plants at this age, though infected, often show no sign of disease. These plants, however, must have become infected in the seed bed, and circumstantial evidence points to the seed as the source of infection. Since the bacteria which cause the disease may be found in vast numbers in the interior of fruit on diseased vines, a few such fruits pulped in a lot of seed tomatoes would contaminate the whole lot of seed. Thorough sterilization of the seed is therefore strongly recommended. The mercuric-chloride method recommended by Gardner and Kendrick⁶ should be satisfactory.



FIG. 7.—Infected, distorted tomato fruits (natural size)

Some infection penetrates the seed coats of seeds in diseased fruit. The number of such seed, however, is negligible, as compared with those externally infected. Here no surface sterilization would be of any value. Care to select seed tomatoes exclusively from healthy vines would be the only safeguard.

Work is in progress to determine the possible carrying over of the disease in the soil of seed bed and field. From all points of view, however, it is wisest to avoid old seed beds, to use only clean, fresh soil in growing tomato plants, and to rotate crops where the disease has occurred. Bacterial canker has not been found on any other crop, nor has it been possible to produce it by inoculation on other solanaceous plants.

⁶ GARDNER, M. W., and KENDRICK, J. B. TOMATO BACTERIAL SPOT AND SEED DISINFECTATION. Ind. Agr. Expt. Sta. Bul. 251, 15 p., illus. 1921.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE

April 2, 1928

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